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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/567,904	08/29/2006	Dai Kobayashi	286249US2PCT	7268

22850 7590 08/22/2008
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EXAMINER	
PURINTON, BROOKE J	

ART UNIT	PAPER NUMBER
2881	

NOTIFICATION DATE	DELIVERY MODE
08/22/2008	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)
	10/567,904	KOBAYASHI ET AL.
	Examiner	Art Unit
	Brooke Purinton	4174

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _10 February 2006_.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1-11_ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1-11_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on _10 February 2006_ is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _5/4/2006_.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Priority

Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Information Disclosure Statement

The information disclosure statement (IDS) submitted on 05/04/2006. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Specification

The specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

The disclosure is objected to because of the following informalities:

Paragraph 103 “an angel [theta]" should be "an angle [theta]". Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims **1 and 3-5** are rejected under 35 U.S.C. 103(a) as being unpatentable over Yasuyuki et al. (Japanese Patent Application Publication Number 06-267408,

where all references are to the translation into English, attached document), Hantschel et al. (United States Patent Number 6668628) and Hansma et al. (United States Patent Number 5825020).

Regarding Claim 1, Yasuyuki et al. teach a probe for a probe microscope using a transparent substrate ("transparent layer" page 6, paragraph 9), comprising: at least one cantilever and which is supported on one surface of the transparent substrate with a predetermined space therefrom (Figure 1, part e, where cantilever 5 is a thin film, and is supported from the transparent substrate 1 by the gap where light beams 7a-7c are shown reflecting through), the transparent substrate being formed of a material transparent to visible light or near-infrared light ("a glass substrate can be used for the substrate if the measuring light ... is visible light, as well as a material which is transparent against the measuring light ... if the measuring light is infrared light," 7, 11), teach having an observation window function which enables optical observation and measurement (Figure 5, where the optical window is clearly the transparent substrate 1) whereby the cantilever is optically observed or measured or is optically driven through the rear surface (surface closest to the light source in Figure 5) of the transparent substrate ("measuring light 7a which is output from light source 51 is reflected in the probe direction," 13, line 2-3, the measuring light which is reflected and detected so comprising a z direction displacement signal and "it is possible to observe the surface state of the sample with a display device 58 by using the Z-direction feedback signal which varies by the surface state of the sample," 13, paragraph 34, 2^{nd} line from the bottom).

Yasuyuki et al. fail to explicitly teach that their cantilever is made of a thin film.

Hantschel et al. teach a thin film cantilever ("a relatively thin stress-engineered spring material film 520 (e.g. </= 1.5 microns)," Col 11, lines 50-51).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the thin film cantilever of Hantschel et al. in the probe of Yasuyuki et al., since Hantschel et al. disclose that "for measuring topography in an SPM contact mode the spring constant should be relatively low ... a relatively low spring constant can be produced using a relatively thin stress-engineered spring material film," 11, 47-51).

Yasuyuki et al. fail to explicitly teach partitioning environments of the inside and the outside of a container.

Hansma et al. teach partitioning environments of the inside and the outside of a container (See figure 9, environments of the sample and the light source are separated by the substrate holder 148).

Since it is known in the art to partition environments, as shown by Hansma et al., from the figure shown in Yasuyuki et al.'s Figure 5, where the substrate 1 is forming a separating level, one skilled in the art would recognize the ability to extend part 1 to substantially separate the two environments.

Regarding Claim 2, Yasuyuki et al. and Hantschel et al. teach a probe for a probe microscope using a transparent substrate, according to Claim 1.

Yasuyuki et al. and Hantschel et al. fail to teach wherein a microlens is formed as a part of the transparent substrate, the microlens allows light used for optical

observation or measurement of the cantilever, or for optical driving thereof to converge on the rear surface of the cantilever.

However, Hansma et al. teach wherein a lens is formed as a part of the transparent substrate (Figure 8, lens 94 (in module 114) - part of substrate which is partially transparent where the lens is placed), the lens allows light used for optical observation or measurement of the cantilever, or for optical driving thereof to converge on the rear surface of the cantilever (see Figure 7, where the light 44A is shown for optical measurement is converging on the rear surface of the cantilever 12).

It would have been obvious to incorporate a lens like Hansma et al. use into the modified apparatus of Yasuyuki et al. and Hantschel et al., since Hansma et al. state that "the window 22, which can be a cover glass, forms the boundary to the sample environment. The window 22 can be replaced by another lens that acts in conjunction with the other lenses to focus the incident beam," (3, 60-65). One of ordinary skilled in the art would recognize the helpful attributes of focusing the lens so close to the cantilever, since the light beam would be less likely to be warped by the air around it at that point, nor would any other dispersion be as severe as focusing before the substrate area could incur. The fact that Hansma et al. use multiple lenses doesn't detract from the idea that one lens could be formed in the substrate of Yasuyuki et al. and Hantschel et al. to help focus the laser beam onto the cantilever.

Additionally, Hansma et al. fail to teach the lens being a microlens.

It would have been known in the art to use a microlens in order to create a single substrate made of glass to partition the environments such as Yasuyuki et al. and

Hantschel et al. do, and still retain the focusing power and proximity benefits of a microlens in the apparatus, since this would have made the substrate more compact. Further, making the substrate a monolithic structure would be obvious from Hantschel et al.'s disclosure since they state that "further since the substrate extends the entire length of the released spring probe, the substrate serves to protect the probe tip during transportation and mounting onto a holder chip," (4, 1-4). The use of a microlens placed into the transparent substrate onto which the cantilever is formed as in the modified apparatus of Yasuyuki et al. and Hantschel et al. would ensure that the protection afforded by the single piece - probe would still be present. Lastly, a change in size (such as a lens being a microlens) is generally recognized as being within the level of ordinary skill in the art. *In re Rose*, 105 USPQ 237.

Regarding Claim 3, Yasuyuki et al., Hantschel et al. and Hansma et al. teach the probe for a probe microscope using a transparent substrate, according to Claim 1.

Yasuyuki et al. and Hantschel et al. fail to teach that the front surface of the transparent substrate is slightly inclined to the rear surface thereof in order to prevent the interference between a light reflected on the front surface of the transparent substrate and a light reflected on the rear surface thereof.

Hansma et al. teach the front surface of the transparent substrate is slightly inclined to the rear surface thereof in order to prevent the interference between a light reflected on the front surface of the transparent substrate and a light reflected on the rear surface thereof (demonstrated in Figure 8, as known lens-properties, additionally

where two different focusing points are shown and the light reflected off the lens would likewise not be reflected into the laser beam incident onto the cantilever, when combined with Yasuyuki et al. and Hanstchel et al. as described above in regards to claim 2).

Motivation to combine is the same as above for claim 1, where the major addition of the tilting of the lens of Hansma et al. into the modified apparatus of Claim 1, is integral to the efficient focusing of the laser beam onto the cantilever. Use of a lens, which is well-known in the art, would additionally provide the predictable benefit to divert reflected light away from the primary beam.

Regarding Claim 4, Yasuyuki et al., Hantschel et al. and Hansma et al. teach the probe for a probe microscope using a transparent substrate, according to Claim 1.

Yasuyuki et al. further teach wherein the transparent substrate is also used as a quarter-wave plate ("measuring light ... polarizing direction is rotated by 45 degrees by a quarter wavelength plate 53," 13, line 4, where the quarter wavelength plate 53, transparent to certain wavelengths, is shown as substantially attached the transparent substrate of glass 1, and therefore part of the transparent substrate).

Regarding Claim 5, Yasuyuki et al., Hantschel et al. and Hansma et al. teach the probe for a probe microscope using a transparent substrate, according to Claim 1.

Yasuyuki et al. fail to teach wherein the cantilever has an internal stress, whereby the space between the cantilever and the transparent substrate is gradually increased from a fixed portion of the cantilever toward the free end thereof.

Hantschel et al. teach wherein the cantilever has an internal stress (the cantilever portion of the released spring probe bends away from the substrate due to the internal stress gradient of the spring material film" col 3, lines 20-24), whereby the space between the cantilever and the transparent substrate is gradually increased from a fixed portion of the cantilever toward the free end thereof (see Figure 2).

It would have been obvious to use the internal stress of the spring probe of Hantschel et al. in the traditional probe type of Yasuyuki et al. since Hantschel et al. state that their probes because of its internal stress "facilitate[s] topography measurements that are not possible using conventional probes. In particular, the long relatively vertical free end of the cantilever section is able to access and measure structures that are deeper and narrower than those measureable by conventional probes," (Col 3, lines 40-46). Substitution would yield the predictable results of measuring deeper into the surface of the sample under examination.

Regarding Claim 8, Yasuyuki et al., Hantschle et al. and Hansma et al. teach the probe for a probe microscope using a transparent substrate, according to one of Claims 1 to 5.

Yasuyuki et al. further teach a probe microscope device ("the present invention relates to a detection probe for the very small displacement which is used for detecting

atomic force or tunnel current, and to a scanning probe microscope ... which employ this detection probe," page 3, paragraph 1), with a probe that comprises deformation or vibration property of the cantilever, which is caused by interaction with a sample, is optically measured through the rear surface of the transparent substrate ("this light intensity is varied by the distance between the reflection layer 2 and the reflection 4, in other words, by the cantilever 5's deflection amount. Through the use of this change in light intensity as the z-direction displacement...," 13, 34, where the change in light intensity is used to measure the deformation of the cantilever).

Regarding Claim 9, Yasuyuki et al., Hantschle et al. and Hansma et al. teach the probe microscope device according to Claim 8.

Yakusuki et al. further teach wherein the deformation or the vibration property of the cantilever is detected from the change in intensity of reflected light caused by optical interference which occurs between the cantilever and the transparent substrate ("Light reflection received is resulted from the intensity of the multiple interfered reflection light," 13, par 33, also see Figure 4, and the light between 7a-7c where it is between the cantilever and the substrate).

Claim **6** is rejected under 35 U.S.C. 103(a) as being unpatentable over Yasuyuki et al. and Shimada et al. (United States Patent Publication Number 2002/0024004).

Regarding Claim 6, Yasuyuki et al. teach a method for manufacturing a probe for a probe microscope using a transparent substrate, comprising the steps of (a) forming a

cantilever from a single film (Figure 1, d, where the cantilever is the film layer labeled 5); (b) bonding the rear surface of the substrate to a glass substrate (see finished product of 1e, where the rear surface of the glass substrate 1 is bonded indirectly to the cantilever 5) and (c) removing a handling wafer and a buried film of the substrate (see steps 1d – 1e, where buried film 3 is removed, and that is also considered by examiner to be analogous to the handling wafer, since it is a wafer structure which is used only during handling, and not during operation).

Yasuyuki et al. fail to teach using crystalline silicon thin film on an SOI substrate, or that the buried film is an oxide film.

Shimada et al. teach a probe made out of a SOI layer ("there can be employed a method of adjoining an SOI layer of an SOI substrate and removing the handle wafer and the oxide film by polishing or etching," page 3, paragraph 52) and a single crystalline silicon thin film for part of the cantilever ("more specifically it is desirable to employ a monocrystalline silicon substrate of an orientation 100 as the 2nd substrate," 3, 54, where the substrate is partially removed to make the remaining substrate a cantilever).

As evidenced by Shimada et al., these types of substances are known in the prior art as useful substances for creating probes for probe microscopes, and as such, it would have been an obvious design choice to incorporate any of these materials into the probe construction of Yasuyuki et al. as detailed above.

Claim **7** is rejected under 35 U.S.C. 103(a) as being unpatentable over Yasuyuki et al. and Shimada et al. as applied to claim 6 above, and further in view of Hantschel et al.

Regarding Claim 7, Yasuyuki et al. and Shimada et al. teach the method for manufacturing a probe for a probe microscope using a transparent substrate, according to Claim 6.

Yasuyuki et al. and Shimada et al. fail to teach it further comprising the step of forming a probe tip at the free end of the cantilever by wet etching.

Hantschel et al. teach the step of forming a probe tip at the free end of the cantilever by wet etching ("for example, wet etching process to remove exposed portions of spring material film," 10, 22-24).

Wet etching is a known in the art technique and would have been obvious to try in place of Yakusuki's etching with "a mix acid of hydrofluoric acid and nitric acid, for example," (8, 15). As such, this is not a patentable limitation over cited prior art of record.

Claims **10 and 11** are rejected under 35 U.S.C. 103(a) as being unpatentable over Yasuyuki et al., Hantschel et al. and Hansma et al. as applied to claim 8 above, and further in view of Kawakatsu (Patent Number 7220962).

Regarding Claim 10, Yasuyuki et al., Hantschle et al. and Hansma et al. teach the probe microscope device according to Claim 8.

Yasuyuki et al., Hantschle et al. and Hansma et al. fail to teach wherein the cantilever is irradiated to vibrate through the rear surface of the transparent substrate with light, the intensity of which varies at a frequency equal to a resonant frequency of the cantilever.

Kawakatsu et al. teach wherein a cantilever array is irradiated to vibrate through the rear surface of the transparent substrate with light, the intensity of which varies at a frequency equal to a resonant frequency of the cantilever array ("a method for exciting cantilevers includes the step of irradiating the rear surface of a substrate having a large number of cantilevers disposed thereon with intensity-modulated light so as to bring the modulation frequency and the natural frequency of the cantilevers in agreement with each other," Col 3, paragraph 29).

It would have been obvious at the time of the invention to combine the cantilever exciting technique (directed only to one cantilever instead of an array) of Kawakatsu into the modified apparatus of Yasuyuki et al., Hantschle et al. and Hansma et al. in order to excite cantilevers. The other alternatives in the art to excite the cantilever could include complicated piezo electric systems, which this embodiment does not require. The invention of Kawakatsu has the advantage that "by performing excitation and detection both with light, the mechanical part of a product can be simplified and miniaturized, accordingly improving reliability and cleanness of the product," (17, 54-57). Therefore, using the light –cantilever excitation technique of Kawakatsu would be an obvious modification that would yield the predictable results of ensuring mechanical surety and less equipment that could malfunction.

Regarding Claim 11, Yasuyuki et al., Hantschle et al. and Hansma et al. teach the probe microscope device according to Claim 8.

Yasuyuki et al., Hantschle et al. and Hansma et al. fail to teach wherein the cantilever is irradiated with light having a constant intensity through the rear surface of the transparent substrate so as. to generate self-excited vibration in the cantilever.

Kawakatsu teaches cantilevers irradiated with light having a constant intensity through the rear surface of the transparent substrate so as. to generate self-excited vibration in the cantilevers ("method for exciting cantilevers includes the step of irradiating the rear surface of a substrate having a large number of cantilevers disposed thereon with light having a uniform quantity and a uniform wavelength so as to self-excite all cantilevers at respective natural frequencies thereof" 3, 28).

Motivation to combine is the same as given above for Claim 10.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Matsuyama et al. (United States Patent Number 5319961) – See figure 1

Jung et al. (United States Patent Number 5440920) – see Figure 1.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brooke Purinton whose telephone number is (571)270-5384. The examiner can normally be reached on Monday - Friday 7h30-5h00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kimberly D. Nguyen can be reached on (571)272-2402. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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